

CLAIMS

What is claimed is:

1. A substrate for a liquid crystal display device, comprising:

an insulating substrate for holding a liquid crystal having negative dielectric anisotropy between the insulating substrate itself and an opposite substrate; and

a plurality of alignment regulating protrusions formed on the insulating substrate, for regulating alignment of the liquid crystal, the alignment regulating protrusions including those having sectional shapes that are different from each other.

2. The substrate for the liquid crystal display device according to claim 1, wherein the sectional shapes are different from each other in width.

3. The substrate for the liquid crystal display device according to claim 1, wherein the sectional shapes are different from each other in height.

4. The substrate for the liquid crystal display device according to claim 1, further comprising color filters formed between the insulating substrate and the alignment regulating protrusions and disposed in such regions as to be opposed to respective pixel electrodes formed on the opposite substrate.

5. The substrate for the liquid crystal display device

according to claim 4, wherein the alignment regulating protrusions include linear protrusions that are formed obliquely with respect to end portions of each of the pixel electrodes and linear auxiliary protrusions that branch off the protrusions and each of which extends along an associated end portion of each of the pixel electrodes, and wherein the protrusions and the auxiliary protrusions have different sectional shapes.

6. A liquid crystal display device comprising an array substrate having pixel regions that are defined by a plurality of bus lines intersecting alternately, a color filter substrate arranged opposite to the array substrate, and a liquid crystal having negative dielectric anisotropy sealed between the array substrate and the color filter substrate;

wherein the color filter substrate is the substrate for the liquid crystal display device as set forth in claim 1.

7. A liquid crystal display device comprising an array substrate having pixel regions that are defined by a plurality of bus lines intersecting alternately, a color filter substrate arranged opposite to the array substrate, and a liquid crystal having negative dielectric anisotropy sealed between the array substrate and the color filter substrate;

wherein the array substrate is the substrate for the liquid crystal display device as set forth in claim 1.

8. A manufacturing method of a substrate for a liquid crystal display device, comprising the steps of:

forming a plurality of thermoplastic resin layers having

different line widths by applying a thermoplastic resin on an insulating substrate and patterning the thermoplastic resin; and

forming a plurality of alignment regulating protrusions having different heights simultaneously by heat-treating the thermoplastic resin layers.

9. A substrate for a liquid crystal display device, comprising:

an insulating substrate for holding a liquid crystal between the insulating substrate itself and an opposite substrate;

a plurality of resin spacers formed on the insulating substrate, for regulating a cell thickness; and

a plurality of dummy patterns made of the same material as the resin spacers formed on the insulating substrate in such a manner that top surfaces of the dummy patterns are lower than those of the resin spacers.

10. The substrate for the liquid crystal display device according to claim 9, wherein base surfaces of the resin spacers are higher than those of the dummy patterns.

11. The substrate for the liquid crystal display device according to claim 10, wherein the base surfaces of the resin spacers are top surfaces of elevated portions formed by laminating color filter forming layers one on another.

12. The substrate for the liquid crystal display device

according to claim 10, wherein the base surfaces of the resin spacers are top surfaces of portions made of a black resin.

13. The substrate for the liquid crystal display device according to claim 9, further comprising dummy test patterns formed on the insulating substrate and having a smaller area than the dummy patterns when viewed perpendicular to a surface of the substrate.

14. The substrate for the liquid crystal display device according to claim 13, wherein the dummy test patterns are made of the same material as the resin spacers.

15. The substrate for the liquid crystal display device according to claim 14, wherein the material of the resin spacers is a novolak resin type photosensitive photoresist.

16. The substrate for the liquid crystal display device according to claim 13, wherein the dummy test patterns are formed by using an exposure mask having a pattern formation width that is close to a resolution limit.

17. The substrate for the liquid crystal display device according to claim 16, wherein the pattern formation width is in a range of 2 μm to 8 μm .

18. The substrate for the liquid crystal display device according to claim 9, wherein a total area of the resin spacers and the dummy patterns as viewed perpendicular to a surface of

the substrate is 10% or more of an area of a display area.

19. The substrate for the liquid crystal display device according to claim 9, further comprising:

color filters formed between the insulating substrate and the resin spacers and disposed in such regions as to be opposed to respective pixel electrodes formed on the opposite substrate; and

a light shield film formed between the insulating substrate and the resin spacers and disposed in a region excluding the regions to be opposed to the respective pixel electrodes.

20. The substrate for the liquid crystal display device according to claim 19, wherein the dummy patterns are formed on the light shield film.

21. The substrate for the liquid crystal display device according to claim 19, further comprising dummy test patterns formed on the light shield film and having a smaller area than the dummy patterns when viewed perpendicular to a surface of the substrate.

22. A liquid crystal display device comprising an array substrate having pixel regions that are defined by a plurality of bus lines intersecting alternately, a color filter substrate arranged opposite to the array substrate and having color filter in each of the pixel regions, and a liquid crystal sealed between the array substrate and the color filter substrate;

wherein the color filter substrate is the substrate for

the liquid crystal display device as set forth in claim 9.

23. A liquid crystal display device comprising an array substrate having pixel regions that are defined by a plurality of bus lines intersecting alternately, a color filter substrate arranged opposite to the array substrate and having color filter in each of the pixel regions, and a liquid crystal sealed between the array substrate and the color filter substrate;

wherein the array substrate is the substrate for the liquid crystal display device as set forth in claim 9.

24. A manufacturing method of a liquid crystal display device, comprising the steps of:

a spacer forming step of forming a plurality of resin spacers for regulating a cell thickness and a plurality of dummy patterns whose top surfaces are lower than top surfaces of the resin spacers by applying a resin material on an insulating substrate and patterning the resin material;

a testing step of checking whether the plurality of the resin spacers have thickness unevenness by irradiating the dummy patterns with light; and

a sealing step of a liquid crystal of attaching the substrate to an opposite substrate and sealing a liquid crystal between the both substrates.

25. The manufacturing method of the liquid crystal display device according to claim 24, wherein the spacer forming step further forms dummy test patterns having a smaller area than the dummy patterns when viewed perpendicular to a substrate

surface, the dummy test patterns serving to check whether the resin spacers are thicker or thinner than a reference thickness.

26. The manufacturing method of the liquid crystal display device according to claim 25, wherein the spacer forming step forms the dummy test patterns using an exposure mask having a pattern formation width that is close to a resolution limit.

27. The manufacturing method of the liquid crystal display device according to claim 25, wherein the testing step further checks whether a portion where thickness unevenness is found based on the dummy patterns is thicker or thinner than the reference thickness.